Regional Supervisor
Division of Wildlife Refuges

February 8, 1967

EH-R Tewaukon
Water Mgmt. Program

Regional Engineer

Tewaukon Refuge - 1967 Annual Water Program

We have reviewed and generally concur in the program proposed for 1967. Pool 1 shall be drawndown or held at or below elevation 1146 during the construction season of 1967.

The water use summary attached for calendar year 1966 is an excellent one and the refuge manager and his staff are to be complimented on a good job. We are also pleased to receive the sketch map showing the relative locations of the various pools including small subimpoundments referred to in the program. We are still not certain as to the exact location of Pool 2A as this was not included on the sketch map.

Hughes 2-8-67
Doeling 2-9-67
Umberger 2/9

The water use summary for Tewaukon Refuge on page 3 of the program correctly gives 23,816 acre-feet inflow. However, the statement following the table appears to be in error, as computed outflow on page 4 of the report is 19,414 acre-feet and the resulting consumptive use for 1966 is 4,392 acre-feet and not 2,404 as shown. We might add that the work on page 4 could be shortened somewhat by not computing outflow to hundredths. Cubic feet per second and acre-feet outflow need only be computed to the nearest whole number.

The north-south township road on the west end of Pool 3 will continue to cause an operation problem for Pool 3 even after the Pool 4 structure is complete. It will be necessary to keep Pool 3 low prior to spring runoff each year to prevent aggravation of the road flood problem. At 1156 elevation in Pool 3 there will be only 1 foot of clearance under the existing bridge and some work is needed to improve on this situation.

The manager's report on easement refuges is also well detailed. The pictures attached to the report are extremely beneficial to us and the summary water use report is extremely valuable.

The Wild Rice and Maple River easement refuge structures must be replaced to preserve our water rights on these areas. Maple River structure work is scheduled for this year. The Wild Rice structure should be given immediate consideration as we can lose our water right on the area if 3 years pass with non-use.

The Storm Lake structure needs a slide gate replacement. We do not appear to be in danger of losing our water right on this area regardless of whether or not the slide gate is replaced. The problem here would seem to be one of receiving too much water at times when we might not need it. Engineering recommended repair of this structure in May, 1960.

Again, we wish to compliment the Manager on a well-documented report. The water use report for each preceding calendar year will now be used in reporting annual water use to the State Engineer.

John D. Umberger

CWStephan:jmf

OPTIONAL FORM NO. 10
5010-108

UNITED STATES GOVERNMENT

Memorandum

TO : Regional Engineer,
Minneapolis, Minnesota

DATE: January 23, 1967

FROM : Assistant Regional Supervisor, Division
of Wildlife Refuges, Minneapolis, Minnesota

1-23-67

SUBJECT: Management of Pool #1 and Pool #3 at Tewaukon NWR

Pool #1 will be held at or below elevation 1146 and Pool #3 will be drawn down or held at or below elevation 1152 during the construction season of 1967.

Edward J. Smith

Edward J. Smith

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA GEN. REG. NO. 27

5010-107

UNITED STATES GOVERNMENT

Memorandum

TO : Regional Director, BSF&W, Mpls. 8, Minn.

DATE: January 20, 1967

FROM : Refuge Manager, Tewaukon Refuge
Cayuga, North Dakota

SUBJECT: Water Use (1966) and Water Management Plan (1967)

Impoundment data, flow records for Lake Tewaukon, 1966 water use and the water management plan for 1967 are attached. Included are data requested for easement refuges under our control.

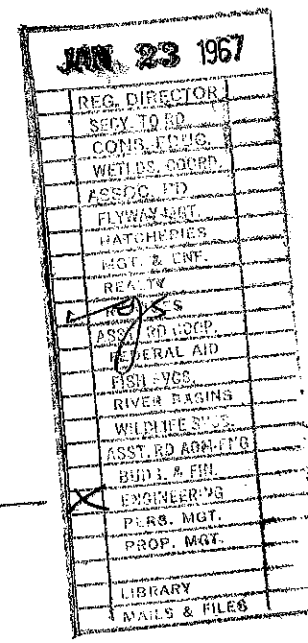
Also enclosed are pictures and a letter sized map showing the location of water gauges on the refuge.

The stream flow records of the U. S. Geological Survey for the Rutland and Cayuga gauging stations are included for your information and records.

Herbert G. Troester

Herbert G. Troester

Attachments



Enge
You may keep this for your file copy
EJS

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AL WATER PROGRAM - TEWAUKON REI E

I. 1966 Water Use Data.

IMPOUNDMENT DATA

Lake Tewaukon for Calendar Year 1966
(spillway elevation 1147)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	6.60 *	1146.60	1,053	6,475
Feb.	6.60 *	1146.60	1,053	6,475
Mar.	8.67	1148.67	1,256	8,950
Apr.	7.67	1147.67	1,144	7,620
May	7.39	1147.39	1,114	7,260
June	7.18	1147.18	1,093	7,000
July	7.19	1147.19	1,094	7,020
Aug.	7.03	1147.03	1,082	6,830
Sept.	6.91	1146.91	1,073	6,780
Oct.	6.61	1146.61	1,053	6,475
Nov.	5.85	1145.85	935	5,745
Dec.	5.70	1145.70	910	5,595

Cutler Marsh for Calendar Year 1966
(spillway elevation 1149)

Month	Gauge Reading (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	6.60 *	1146.60	115	125
Feb.	6.60 *	1146.60	115	125
Mar.	10.18	1150.18	240	719
Apr.	9.27	1149.27	213	470
May	8.10	1148.10	165	300
June	7.37	1147.37	148	201
July	7.45	1147.45	149	202
Aug.	7.13	1147.13	142	162
Sept.	7.01	1147.01	139	159
Oct.	6.82	1146.82	121	137
Nov.	6.20 *	1146.20	100 *	
Dec.	6.20 *	1146.20	100 *	

White Lake for Calendar Year 1966
(spillway elevation 1149)

Month	Gauge Reading (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	8.16	1148.16	185	430
Feb.	8.16	1148.16	185	430
Mar.	10.71	1150.71	367	720
Apr.	9.38	1149.38	278	544
May	8.62	1148.62	212	465
June	8.22	1148.22	188	436
July	8.40	1148.40	197	445
Aug.	8.26	1148.26	190	438
Sept.	8.00	1148.00	181	421
Oct.	7.79	1147.79	179	418
Nov.	7.73	1147.73	175	414
Dec.	7.70	1147.70	172	410

+ Outlet reading * Estimated

Clouds Lake for Calendar Year 1966
(spillway elevation 1179)

Month	Gauge Reading (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	4.79 *	1174.79	106	460
Feb.	4.79 *	1174.79	106	460
Mar.	7.44	1177.44	134	634
Apr.	8.14	1178.14	144	715
May	8.04	1178.04	140	710
June	7.72	1177.72	138	677
July	7.45	1177.45	134	634
Aug.	7.18	1177.18	132	601
Sept.	6.92	1176.92	129	554
Oct.	6.68	1176.68	128	550
Nov.	6.23	1176.23	123	502
Dec.	6.23	1176.23	123	502

Sprague Lake for Calendar Year 1966
(spillway elevation 1212) *

Month	Gauge Reading (average) +	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	4.80 *	1210.80	169	897
Feb.	4.80 *	1210.80	169	897
Mar.	9.00	1215.00	252	1,490
Apr.	6.91	1212.91	186	1,185
May	6.94	1212.94	187	1,190
June	6.67	1212.67	185	1,150
July	6.58	1212.58	184	1,135
Aug.	6.44	1212.44	183	1,115
Sept.	6.07	1212.07	180	1,060
Oct.	5.86	1211.86	178	1,030
Nov.	5.80	1211.80	178	1,020
Dec.	5.80	1211.80	178	1,020

Mann Lake for Calendar Year 1966

Month	Gauge Reading (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	8.44 *	1208.44	45	177
Feb.	8.44 *	1208.44	45	177
Mar.	13.20	1213.20	62	466
Apr.	10.00	1210.00	52	250
May	10.05	1210.05	52	251
June	9.57	1209.57	50	228
July	9.54	1209.54	50	227
Aug.	9.10	1209.10	48	206
Sept.	8.71	1208.71	46	189
Oct.	8.52	1208.52	45	180
Nov.	8.48	1208.48	45	178
Dec.	8.48	1208.48	45	178

* Estimated + All months are 0.0 on gauge 1206.00

Small Impoundments, 1966
(Clouds Lake drainage)

Month	Pool #3	Pool #5	Pool #6	Pool #7
Jan.	dry	dry	dry	dry
Feb.	dry	dry	dry	dry
Mar.	dry	1162.79	1166.99	dry
Apr.	dry	1163.39	1167.36	dry
May	dry	1162.55	1166.66	dry
June	dry	1162.23	1166.70	dry
July	dry	1162.15	1167.27	dry
Aug.	dry	1161.98	1167.15	dry
Sept.	dry	1161.90	(not available)	dry
Oct.	partially filled	1162.15	1165.00	partially filled
Nov.	filled	1162.73	1167.00	partially filled
Dec.	1' ice	1162.73	1167.00	partially filled

Tewaukon Refuge, Consumptive Water Use For 1966

	A Ave. Annual Evap.	B 1966 Lake Rise	C Net Gain A+B	D Surface Acres	E Ac-Ft Gain CxD	F Outflow in ac-ft	G Total Inflow ac-ft E+F
Sprague Lake	2.65'	1.00'	3.65'	186	678	None	678
Mann Lake	2.65'	.04'	2.69'	48	129	"	129
Pool #10	2.65'	.00'	2.65'	5	13	"	13
Pool #9	2.65'	.01'	2.66'	10	27	"	27
Pool #8	2.65'	1.44'	4.09'	128	525	"	525
Pool #7	2.65'	1.00'	3.65'	20	73	"	73
Pool #6	2.65'	.01'	2.66'	8	21	"	21
Pool #5	2.65'	-.06'	2.59'	13	34	"	34
Pool #3	2.65'	1.00'	3.65'	35	128	"	128
Pool #2	2.65'	-.40'	2.25'	145	326	"	326
White Lake (11+12)	2.65'	-.46'	2.19'	206	450	"	450
Lake Tewaukon	2.65'	-.90'	1.75'	1,074	1,880	19,532	21,412

23816 Total Inflow

Total inflow to Tewaukon Refuge was 23,816 acre feet in 1966, and total outflow was ~~21,412~~ 19414 acre feet, so the consumptive water use was ~~2,401~~ 4392 acre feet.

23,806
- 19414
4392

Outflow Data, 1966, In C.F.S.

Lake Tewaukon Structure

Date	March	April	May	June	July	Aug.	Sept.	Oct.
1	None	151.00	37.00	13.00	22.00	0	0	0
2	"	151.00	*36.05	13.00	22.00	0	0	0
3	"	151.00	36.05	13.00	22.00	0	0	0
4	"	*113.05	36.05	13.00	22.00	0	0	0
5	"	91.00	36.05	13.00	*23.45	0	0	0
6	"	91.00	36.05	*14.88	20.00	0	0	0
7	"	91.00	37.50	9.00	20.00	0	0	0
8	"	91.00	37.50	9.00	20.00	0	0	0
9	"	91.00	*37.81	9.00	20.00	0	0	0
10	"	91.00	34.00	9.00	20.00	0	0	0
11	"	*68.25	34.00	9.00	*15.75	0	0	0
12	"	57.00	34.00	9.00	12.00	0	0	0
13	*46.55	57.00	34.00	*2.94	12.00	0	0	0
14	*99.40	57.00	34.00	2.94	12.00	0	0	0
15	*172.90	57.00	34.00	2.94	12.00	*2.21	0	0
16	*253.75	57.00	34.00	2.94	12.00	1.80	0	0
17	*359.65	57.00	*29.40	2.94	12.00	1.80	0	*16.20
18	*469.00	*45.15	29.40	2.94	*8.58	1.80	0	18.00
19	*488.60	42.00	29.40	2.94	5.00	1.80	0	18.00
20	*477.70	42.00	29.40	*2.94	5.00	1.80	0	18.00
21	*457.80	42.00	29.40	12.00	5.00	*1.47	0	18.00
22	*438.55	42.00	29.40	12.00	4.00	2.50	0	18.00
23	*406.70	42.00	*29.40	12.00	4.00	2.50	0	18.00
24	*344.75	42.00	20.00	12.00	4.00	2.50	0	*20.55
25	302.00	*38.85	20.00	12.00	0	2.50	0	14.00
26	302.00	37.00	20.00	12.00	0	2.50	0	14.00
27	302.00	37.00	20.00	*21.28	0	2.50	0	14.00
28	*258.30	37.00	20.00	22.00	0	2.50	0	13.00
29	224.00	37.00	20.00	22.00	0	*3.68	0	13.00
30	224.00	37.00	20.00	22.00	0	3.68	0	13.00
31	*189.00		*10.50		0	3.68	0	*6.45
C.F.S. Total	5,816.65	2,043.30	924.36	314.68	334.78	41.22	0	232.20
Ac-Ft Total	11,633.30	4,086.60	1,848.72	629.36	669.56	82.44	0	464.40

C.F.S. Grand Total - 9,707.19 9,707.19 Second Foot Days = 19,414.38 Acre Feet Discharge
Ac-Ft. Grand Total - 19,414.38

* This is known data, all other figures are interpolations.

USGS Provisional @ Portland = 12,447 (Total Mileage 546 SQMi) Contrib. D.A. 34
" " " Cayuga = 28936 (955 ") 565
Tewaukon = 661 SQMi. D.A. 19,414 462

SUMMARY OF 1966 WATER PROGRAM

Spring Run-off

Clouds Lake Watershed

A warming period in February contributed to a slight local run-off in the area.

The major run-off began on March 10, following the early March blizzard. Water poured into the T-2 watershed retention dam, photograph #1, faster than it could be released. It became apparent that we would need to pass this accumulated water as quickly as possible, so on March 10 water was released from Pool #7. This water and local run-off rapidly filled Pool #5 and #6. Clouds Lake, fortunately in drawdown, began rising rapidly from local run-off and from T-2 water. On March 13 the gate on Clouds Lake was opened to reduce this rise.

All gates on all pools were open until March 23. Cold winds on this date froze the culverts on Pools #7, #6, #5 and #3A. Clouds Lake and Pool #7 were closed until March 24, when the culverts on the pools again opened up.

By March 24, local run-off into Clouds Lake had almost subsided and the majority of the inflow was from T-2. Water was still about three feet above the orifice in T-2 on March 25.

Wild Rice River Watershed

Heavy flows reached the Sprague Lake Unit on March 14. Both the Wild Rice River and Sprague Lake went over the roads.

Heavy flows reached the Tewaukon Unit on March 16. Cutlers Marsh (Pool #2) rose almost 1.5 feet overnight. Water also moved from Cutlers Marsh to White Lake, pushing that lake up high. High water reached the Tewaukon structure on March 19, photograph #2. Peak water levels went over the old county road on the north side of Lake Tewaukon.

The lack of significant precipitation and cool weather, during the end of March, helped reduce the flow and the water receded without damage, photograph #3.

1966 Water Conditions

Water condtions remained excellent from April through June. June rains refilled potholes and water began flowing again in the Wild Rice River and tributaries until July.

Water levels fell rapidly in the lakes and potholes during July. Pools #5 and #6 had to be refilled with water from Clouds Lake.

Above normal rains in August started water flowing in the Wild Rice River, Clouds Lake drainage and the drainage into the east end of Lake Tewaukon. All lakes and potholes filled during these August rains.

Water conditions continued good the remainder of the fall.

Food

Unused crops on the refuge were abundant and received heavy utilization by mallards and pintails during March.

Food and cover remained adequate throughout the summer months. Excellent stands of emergents became evident in July. Areas free of carp responded well with emergents and submergents, particularily sago, in good supply.

Sago has increased substantially in Clouds Lake since the 1965 chemical carp eradication, photograph #4.

Millet grown in Pools #7N and #3A provided additional fall food which was heavily utilized by ducks and geese, photographs #5 and #6.

Waterfowl Use

Ducks found ideal nesting conditions on the refuge in 1966. The breeding pair counts showed 599 pairs this year compared to the previous 10 year average of 420 pairs.

With the exception of the carp infested White, Tewaukon, Mann and Sprague Lakes, water areas had good brood cover and received good brood use.

Vegetation and waterfowl response to the 1965 chemical carp control in Clouds Lake has been very encouraging. Submerged aquatics, particularily sago, are continuing to increase from their former depleted state. Duck broods and duck and goose migration use has increased sharply in the lake.

Cutlers Marsh was used extensively by ducks during the summer and by ducks and geese in the fall. The Amitrol "T" application on the cattails in 1963 created good interspersion of emergent vegetation and an increase in waterfowl use.

1967 ANNUAL WATER PROGRAM

Six newly constructed water control structures on the refuge will provide the opportunity for more intensive water management. These structures, for the most part, will be functional for the spring run-off. Exceptions to this plan may be necessary to allow the contractor to complete certain work items. For example, the repair of the cement honeycomb in structures #11 and #12 may require the lowering of Pools #11, #12 and #2.

Minor improvements of the structures, not included in the construction bids, will be completed by refuge personnel. Grasses will be seeded on the dikes and borrow areas of Pools #2, #3, #7N, #7E, #11 and #12. Seed-bed preparation and grass establishment on the Clouds Lake watershed flood spillway will be accomplished according to SCS recommendations. Rip-rap will be installed around outlet pipes at Pools #7N, #7E, #11 and #12, as suggested by Engineer J.R. Wright.

This year's plan has incorporated the proposed SCS diversion of the Clouds Lake watershed into White Lake (see discussion of White Lake watershed).

The Water Management Program is described for the Tewaukon Unit and for the Sprague Lake Unit. The Tewaukon Unit is described according to water source: Wild Rice River, Direct; White Lake Watershed; and Clouds Lake Watershed.

TEWAUKON UNIT

I. Wild Rice River Watershed, Direct

Pool #4

The construction of the control structure at Pool #4 will be completed during the summer of 1967. River flow will undoubtedly have stopped by mid-summer so no water will be available for impounding in this pool.

Seeding of grasses on the dikes and borrow areas will be accomplished upon the completion of the structure.

A carp control facility should be installed in the structure during 1967, prior to 1968 river flow. Beginning in 1968, the Pool #4 structure will be the primary upstream carp control on the refuge.

Pool #3 - Maka Pool

Pool #3 presently consists only of a small pond in the northeast portion of the pool basin.

With the newly completed structure, water will be impounded to the 1155' elevation, commencing immediately after the peak spring run-off. (Water retained during the peak run-off could cause damage to the township road on the west end of the pool). Water impounded below the maximum pool elevation of 1156' will provide somewhat drier working conditions for the construction of Pool #4.

Discussions will be held with the Area Biologist to determine the desirability of loafing islands in Pool #3. If these islands are recommended at this time, the pool will be drawn down in the summer for their construction. Some reflooding may subsequently be possible in the fall from water in Clouds Lake.

Pool #2 - Cutlers Marsh

Pool #2 is presently drawn down by means of structure #1 for carp control and for the construction of structure #2.

Anticipated water from the White Lake watershed will require its rapid discharge into Pool #2 (see White Lake watershed discussion). These conditions will require the holding of Pool #2 at 1146' until water has discharged through Pools #11 and #12. The above precautions are necessary to keep Pool #11 from going over the 1150' elevation. Upon completion of the White Lake watershed discharge, stoplogs will be installed in structures #12 and #2 and water retained in Pool #2 to the 1152' elevation.

Carp control facilities will be installed in this structure to restrict rough fish from entering Pool #2 from Lake Tewaukon.

Pool #2A

A concrete metal pipe with slide gate will be installed on the south end of dike #3 to pass water as needed into Pool #2A. The flow elevation of this pipe should be about 1152' to maintain a water source for #2A during low water levels in Pool #3. About one day's work by refuge personnel, including several hours work with a dragline, is all that is needed to make Pool #2A functional.

Dugouts with associated loafing sites may be constructed around the periphery of Pool #2A.

Pool #1 - Lake Tewaukon

Lake Tewaukon is presently at a drawn down elevation of 1145.7' for carp control in Pool #2 and for construction of structure #2.

The construction of a swimming beach and boat launching ramp will require a low elevation of Lake Tewaukon. It will be held at 1146.0 for the water year. Should the construction be finished and heavy rains provide a water source, it could be raised to 1148.0 for the winter.

Shoreline erosion at the 1149' elevation is of concern in some areas of the pool. Rocks for rip-rapping will be hauled during the summer to areas receiving excessive erosion. Some of this rip-rap may be placed during the following winter, to allow heavy equipment to work on the ice and frozen shoreline.

II. White Lake Watershed

Spring run-off from the Clouds Lake watershed will be diverted into the White Lake watershed by the Soil Conservation Service. This diversion will allow the establishment of grasses in the newly excavated channel from their T-2 reservoir into Clouds Lake. If excessive run-off occurs, which may cause damage in the White Lake watershed, the temporary diversion dike at T-2 will be excavated to pass this excess water into Clouds Lake. Water will be allowed to pass into Clouds Lake only when it appears that Pool #11 would go over the 1150' elevation.

Pool #11

Pool #11 is presently at the 1147.7' elevation.

Stoplogs will remain out of this structure during spring run-off to allow free movement of water. When spring run-off is nearly completed, stoplogs will be installed to the 1149' elevation. This elevation will allow one foot of freeboard in the pool in case of heavy rains.

Pool #12

The present elevation of Pool #12 is 1147.7'.

Stoplogs will remain out of the structure until waterflow in the White Lake watershed is completed. Upon completion of the run-off, stoplogs will be installed in the structure to allow Pool #2 to be raised to 1152'.

If practical, a carp screen will be installed in this structure to restrict the present carp in Pool #12 from entering Pool #2.

III. Clouds Lake Watershed

The management of the pools on the Clouds Lake flowage in 1967 will depend largely on the abundance of the reduced water supply (see White Lake watershed discussion).

Pool #8 - Clouds Lake

The present elevation of Clouds Lake is 1176.2'. Local run-off may be the only source of water during 1967 and is not expected to bring the lake up to the maximum 1179' elevation. All available water will be retained up to the 1179' elevation and released sparingly when needed in pools downstream.

Pool #9

Water will be supplied from Clouds Lake to this pool as needed.

Pool #10

Water will be supplied from Clouds Lake to this pool as needed.

Pool #7N

Millet will again be grown in this pool basin and flooded to the 1177' elevation in the fall.

Stoplogs will be installed in the 7N structure and all of the water passed will go through the gate valve to 7E.

Pool #7E

This pool will be held at the 1172' elevation throughout the year. This elevation will provide the maximum amount of water in Pool #7E and still permit farming operations in Pool #7N.

Water will be supplied from Clouds Lake as needed.

Pool #6

Pool #6 will be maintained at the 1166' elevation. Water will be provided as needed from Clouds Lake.

Pool #5

Pool #5 will be maintained at 1162' from water from Clouds Lake.

This structure will be the primary carp barrier in the Clouds Lake flowage in 1967. This will require the maintenance of a large head of water to prevent carp movement (invert elevation 1155.4').

Pool #3A

Pool #3A will continue to be managed as a separate pool. This dike provides more intensive management and also is required for the road along Pool #3 and part of Pool #2.

The present elevation of the dike (1156.1 - 1157.6) will be raised to 1160', the same elevation of the Pool #3 dike.

Water will be supplied from Clouds Lake and held at 1155' prior to raising the dike. Water could be held at 1157' following dike completion.

SPRAGUE LAKE UNIT

No development of water controls has taken place on this unit. Some minor development, such as the blasting of potholes and the plugging of ditches, will be accomplished during 1967.

A beaver dam located in the SW¼SW¼ of Section 35, T. 130 N., R. 55 W., is currently impounding water within about one foot of the top of the township road. Removal or lowering of this dam may be necessary to avoid water damage to the road during the spring flow.

Sprague Lake

No water control is available on this lake.

The high rate of siltation into the lake from the new watershed channel will be examined during the spring run-off. If it appears that the erosion will continue to be a problem, steps should be taken to stabilize the channel, photograph #7.

Water will be diverted or pumped into the marsh to the west and to the marsh to the south if needed.

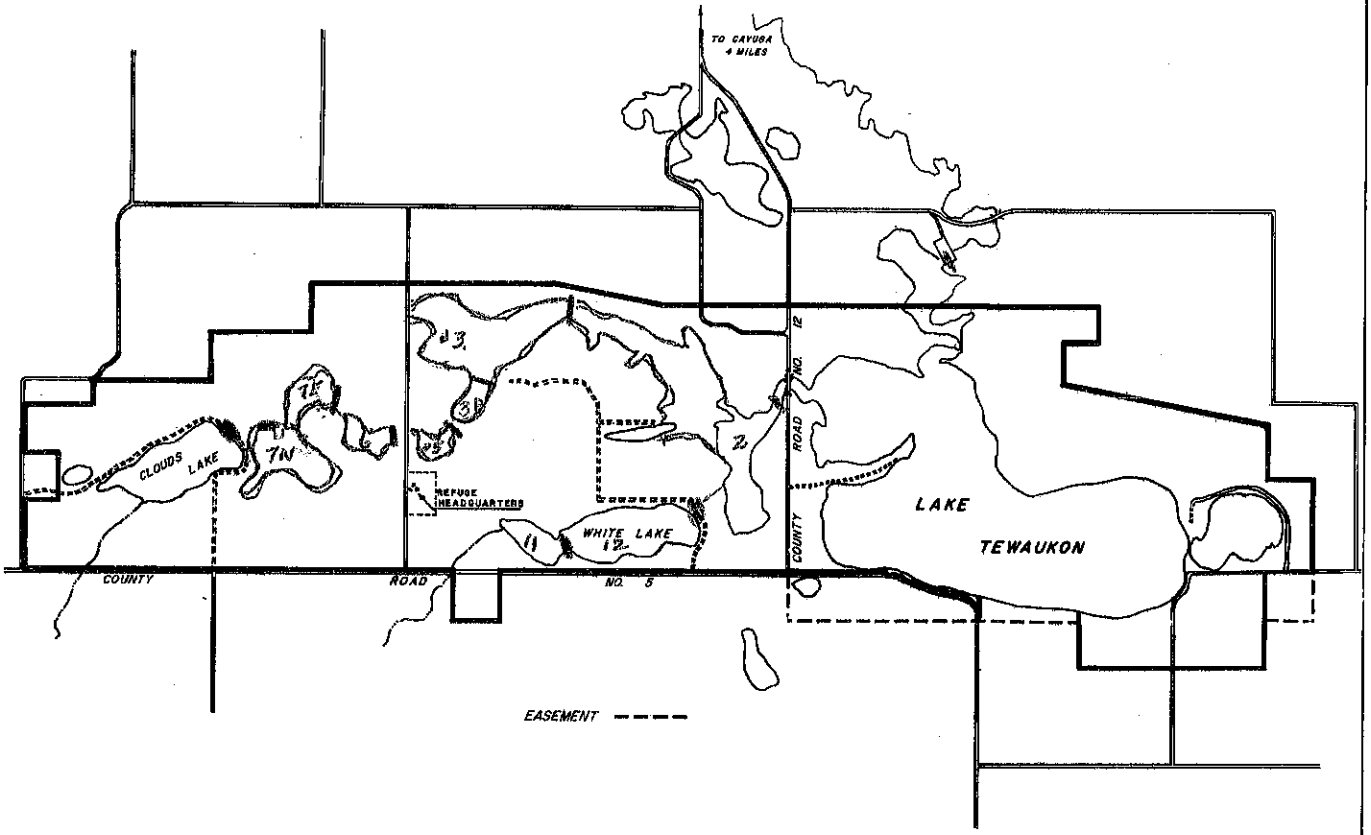
Mann Lake

Mann Lake water elevations are determined by the level of the Wild Rice River. No management of water levels will be possible in 1967.

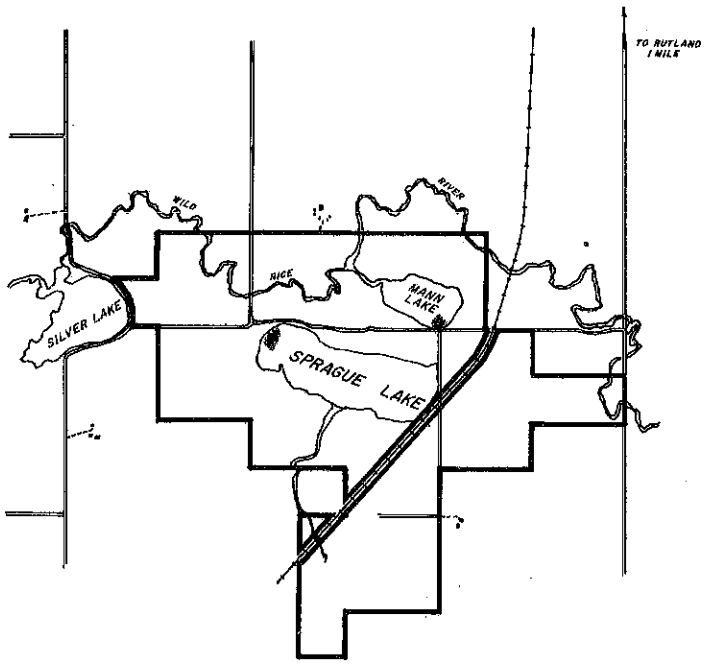
UNITED STATES
DEPARTMENT OF THE INTERIOR

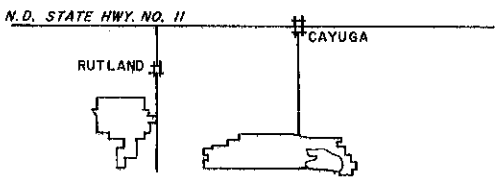
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

TEWAUKON NATIONAL WILDLIFE REFUGE



SPRAGUE LAKE DIVISION





1966 EASEMENT REFUGE WATER USE - TEWAUKON DISTRICT

The following is all available information on easement refuges in this district. Water gauges, where absent, have been installed for future water-use data. Inflow and outflow data is largely unavailable.

Easement Refuges, Consumptive Water Use For 1966

Refuge	A Ave. Annual Evap.	B 1966 Lake Rise	C Net Gain A+B	D Surface Acres	E* Ac-Ft Gain CxD	F Outflow in ac-ft	G Total Inflow ac-ft E+F
Bonehill	2.65'	Unk.	2.65'	40	106	**Unk.	Unk.
Lake Elsie	2.65'	.71	3.36'	317	1,065	None	1,065
Maple River	2.65'	Unk.	2.65'	75	199	Unk.	Unk.
Storm Lake	2.65'	Unk.	2.65'	181	480	Unk.	***Unk.
Wild Rice	2.65'	None	2.65'	****3	8	29,048	29,056 [1]

* Water use.
** Water reportedly ran over 50' sod spillway with a 10% slope for about a two week period at an estimated depth of one foot.
*** Control structure designed to provide or restrict water to the lake is non-functional.
**** Beaver dam.

[1] USGS Provisional Records at Cayuga for 1966 water year. (Actually 28936 Acre-ft for Calendar yr. 1966.)

Physical Condition of Control Structures

Bonehill Refuge, LaMoure County

The main dike, photograph #8, is on the north pool and is in good condition, with only a minor amount of animal burrow damage. A slight amount of seepage occurs through the dike. The rip-rapping on the dike, photograph #9, remains in excellent condition. The sod spillway is receiving a slight amount of erosion on its lower end and may need minor repairs within the next 3-5 years.

The small stone structure, photograph #10, designed to retain water in the 20 acre south pool is completely ineffective. However, present water conditions in the pool are more than adequate, witnessed by the complete lack of emergent vegetation, so this structure is not needed. High water passes freely into the north pool and during heavy spring run-off both pools are continuous.

Lake Elsie Refuge, Richland County

Lake Elsie is a natural lake basin without outlets and water controls.

Maple River Refuge, Dickey County

The Maple River control structure, photograph 11, completely lost its effectiveness during the spring of 1966. Plans are to build a new structure here in the near future.

Storm Lake Refuge, Sargent County

The Storm Lake water control structure, photographs #12 and #13, which provides or restricts water to Storm Lake, is presently non-functional. This structure is located adjacent to a legal ditch which passes one-half mile north of the lake. The ditch from the control structure to the lake, photograph #14, is filled with trees, brush and debris, retaining the water in the ditch to the top of the inlet opening.

The steel gate on the bottom of the structure was removed by vandals. Local people in Milnor prefer high water in Storm Lake to reduce algae bloom and to reduce flooding in the legal ditch. The legal ditch reportedly overflows into the residential area of Milnor and causes basement flooding.

Wild Rice Lake Refuge, Sargent County

This control structure washed out some years back and still remains non-functional. A beaver dam on the river is currently holding back about a three foot head of water.